

IN THE CLAIMS:

1           23.   (Currently Amended) A vehicle collision avoidance system

2   comprising:

3                   a circumferentially rotating pulsed infrared laser beam scanner

4   apparatus, wherein the scanner is emitting and receiving the reflected laser

5   beam signal over the 360° field of view, including a laser pulsed emitter and an

6   infrared laser sensor for generating a first signal representative of an obstacle

7   scanned, the laser pulsed emitter rotating circumferentially in a horizontal plane

8   and a vertical plane simultaneously, the infrared laser sensor circumferentially

9   rotating synchronously with the laser pulsed emitter in the horizontal plane and

10   receiving a reflected laser beam signal from the obstacle scanned;

11                  a processing circuit coupled to the circumferentially rotating pulsed

12   infrared laser beam scanner apparatus for processing the first signal and

13   generating a plurality of signals;

14                  a processor coupled to the processing circuit for processing the

15   plurality of signals and generating a braking signal; and

16                  a braking apparatus responsive to the braking signal.

1           24.   (Canceled)

1           25.   (Currently Amended) The vehicle collision avoidance system of

2   claim 1, wherein the circumferentially rotating pulsed infrared laser beam scanner

3   apparatus is operable to scan an object from 1.6m to 120m.

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1 26. (Currently Amended) The vehicle collision avoidance system of  
2 claim 2, wherein the circumferentially rotating pulsed infrared laser beam scanner  
3 apparatus rotates in the horizontal plane at 48 revolutions per second and with a  
4 period of 20.83ms and in the vertical plane at 8 sectors per second and a period  
5 of 20.83ms.

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1 27. (Currently Amended) The vehicle collision avoidance system of  
2 claim 1, wherein the circumferentially rotating pulsed infrared laser beam scanner  
3 apparatus emits a laser beam having 28.45W peak power, an average power of  
4 142mW, a wavelength between 1 $\mu$ m ~~[[1um]]~~ and 1.550 $\mu$ m ~~m~~ excluding the  
5 region between 1.3 $\mu$ m ~~1.3um~~ and 1.4 $\mu$ m ~~1.4um~~, and preferably between  
6 1.450 $\mu$ m and 1.550 $\mu$ m, a 1.0ns to 1.25ns pulse width, ~~[[and]]~~ a 10Mhz to 110Mhz  
7 repetition rate, and a 0.002 radian emitting pulsed laser beam divergent angle.

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1 28. (Canceled)

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1 29. (Currently Amended) A method of avoiding a vehicle collision  
2 comprising:  
3 determining features of an obstacle using a circumferentially  
4 rotating pulsed infrared laser beam scanner apparatus, wherein the scanner is  
5 emitting and receiving the reflected laser beam signal over the 360° field of view.

6 including a circumferentially rotating laser pulsed emitter and a circumferentially  
7 rotating infrared laser sensor;

8  
9 processing signals representative of the determined features; and  
10 braking the vehicle in the event the processed signals indicate an  
11 imminent collision.

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1 30. (Currently Amended) The method of avoiding a vehicle collision of  
2 claim 7, wherein the circumferentially rotating pulsed infrared laser beam scanner  
3 apparatus rotates in a horizontal plane and in a vertical plane simultaneously.

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1 31. (Currently Amended) The method of avoiding a vehicle collision of  
2 claim 7, wherein the circumferentially rotating pulsed infrared laser beam scanner  
3 apparatus emits a laser beam having 28.45W peak power, an average power of  
4 142mW, a wavelength between 1 $\mu$ m [[1um]] and 1.550 $\mu$ m ~~1.550um~~ excluding  
5 the region between 1.3 $\mu$ m [[1.3um]] and 1.4 $\mu$ m [[1.4um]], and preferably between  
6 1.450 $\mu$ m and 1.550 $\mu$ m, a 1.0ns to 1.25ns pulse width, [[and]] 10Mhz to 110Mhz  
7 repetition rate, and a 0.002 radian emitting pulsed laser beam divergent angle.

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1 32. (Canceled)

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1 33, (Currently Amended) A method of avoiding a vehicle collision  
2 comprising:

3                    circumferentially detecting circumferential obstacles as bodies  
4   proximate the vehicle;  
5                    obtaining data from a rotating pulsed infrared laser beam scanner  
6   apparatus including a time when the beam reaches a first edge of each body the  
7   ~~obstacle~~ and a time when the beam reaches a second edge of each body the  
8   ~~obstacle;~~  
9                    determining a relative distance from the scanner apparatus to each  
10   body the obstacle;  
11                    determining a time to collision with each body the obstacle; and  
12                    determining a braking force to avoid a collision with each body the  
13   ~~obstacle.~~

1            34.   (Currently Amended) The method of avoiding a vehicle collision of  
2   claim 11, further comprising determining a critical point at which an absolute  
3   value of  $da/dt$  approaches zero. The method of avoiding a vehicle collision of  
4   claim 11, further comprising determining a critical point at which an absolute  
5   value of the derivative of each bodies acceleration with respect to time  $da/dt$   
6   approaches zero.

1            35.   (Currently Amended) The method of avoiding a vehicle collision of  
2   claim 12, wherein determining the relative distance and determining the time of  
3   collision are initiated at the critical point. The method of avoiding a vehicle

4 collision of claim 12, wherein determining the relative distance and determining  
5 the time of collision are initiated at the critical point.

1 36. (Currently Amended) ~~The method of avoiding a vehicle collision of~~  
2 ~~claim 11, further comprising determining a relative angular velocity of the~~  
3 ~~obstacle.~~ The method of avoiding a vehicle collision of claim 11, further  
4 comprising determining a relative angular velocity of each body the obstacle.

1 37. (Currently Amended) ~~The method of avoiding a vehicle collision of~~  
2 ~~claim 11, wherein determining the time of collision comprises computing a~~  
3 ~~second order factor.~~ The method of avoiding a vehicle collision of claim 11,  
4 wherein determining the time of collision comprises computing a second order  
5 factor.

1 38. (Currently Amended) ~~The method of avoiding a vehicle collision of~~  
2 ~~claim 11, further comprising determining the bumpiness of a road surface.~~ The  
3 method of avoiding a vehicle collision of claim 11, further comprising determining  
4 the bumpiness of a road surface.

1 39. (Currently Amended) ~~The method of avoiding a vehicle collision of~~  
2 ~~claim 16, wherein determining the braking force to avoid a collision with the~~  
3 ~~obstacle comprises determining a first braking force in a case where the time of~~  
4 ~~collision is less than 1.5 seconds and a second braking force in a case where the~~

5 ~~road is bumpy.~~ The method of avoiding a vehicle collision of claim 16, wherein  
6 determining the braking force to avoid a collision with each obstacle ~~the obstacle~~  
7 comprises determining a first braking force in a case where the time of collision is  
8 less than 1.5 seconds and a second braking force in a case where the road is  
9 bumpy.

1 40. (Currently Amended) ~~The method of avoiding a vehicle collision of~~  
2 ~~claim 11, wherein determining the time of collision further comprises determining~~  
3 ~~vertical and horizontal components.~~ The method of avoiding a vehicle collision of  
4 claim 11, wherein determining the time of collision further comprises determining  
5 vertical and horizontal components of each body.

1 41. (Currently Amended) ~~The method of avoiding a vehicle collision of~~  
2 ~~claim 11, further comprising determining a rate of approach of the vehicle and the~~  
3 ~~obstacle.~~ The method of avoiding a vehicle collision of claim 11, further  
4 comprising determining a rate of approach of the vehicle and each body ~~the~~  
5 ~~obstacle.~~

1 42. (Canceled)

1 43. (Currently Amended) ~~The method of avoiding a vehicle collision of~~  
2 ~~claim 11, wherein the obtaining and determining steps are performed in a point to~~  
3 ~~point vector processing manner.~~ The method of avoiding a vehicle collision of  
4 claim 11, wherein the obtaining and determining steps are performed in a point to  
5 point vector processing manner.



44. (Currently Amended) ~~The method of avoiding a vehicle collision of claim 11, further comprising using an analog circuit to process the time when the beam reaches the first edge of the obstacle and the time when the beam reaches the second edge of the obstacle, the relative distance from the scanner apparatus to the obstacle, a relative angular velocity of the obstacle, an acceleration of the obstacle and a derivative of the acceleration.~~ The method of avoiding a vehicle collision of claim 11, further comprising using an analog circuit to process the time when the beam reaches the first edge of each body ~~the obstacle~~ and the time when the beam reaches the second edge of each body ~~the obstacle~~, the relative distance from the scanner apparatus to each body ~~the obstacle~~, a relative angular velocity of each body ~~the obstacle~~, an acceleration of each body ~~the obstacle~~ and a derivative of the acceleration.